ASTRONOMICAL SOCIETY OF LONDON.

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THERE was read a paper by F. Baily, Esq. entitled "Remarks on the Astronomical Observations of Flamsteed." The object of this communication is to draw the attention of astronomers to the observations of that eminent observer, which the author considers, from their great number, from the care bestowed upon them, and from the very long period elapsed since they were made (nearly 140 years), to be deserving of more strict examination than they appear yet to have received. The imperfection of the instruments used by Flamsteed appears to have been one chief cause of this neglect, being in fact only a mural arc of 120°, with cross wires in the focus of the telescope fixed in the plane of the meridian, and an uncompensated clock. The arc, though of 80 inches radius, could be read off only to 10″, or at most, by an estimation of proportional parts, to 5″. With these, however, imperfect as they necessarily were, he succeeded in constructing a catalogue of the mean right ascensions and declinations of about 3000 stars, which has served as a basis for the observations of all subsequent astronomers.

This catalogue was of course very inadequately reduced. Aberration and nutation were unknown in Flamsteed's time, and refraction very imperfectly; so that the catalogue, as it stands, cannot be considered as at all fairly representing the observations. It was, however, for many years the only catalogue in the hands of astronomers, till it gave way to Mayer's, which being deduced from observations made with better instruments, and by an astronomer of great ability, was held more worthy of confidence. But, Mr. Baily observes, the observations of Mayer were made in precisely the same way as Flamsteed's, the right ascensions being determined by the time of the star's passing the vertical wire of the telescope of a mural quadrant. His clock, however, was compensated, and his arc better divided, and no doubt better adjusted. More confidence therefore is to be placed in any *one* observation of Mayer's than in any corresponding *one* of Flamsteed's. But the number of Mayer's stars is not above one-third of Flamsteed's; the greater part were observed only *once*, and not above fifty so often as six or seven times. Whereas Flamsteed observed most of his stars several times; above a tenth part more than ten times; many of them more than fifty, and some even more than 100: thus ν *Geminorum* was observed 103 times; *Spica* 108; γ *Geminorum* 124; *Aldebaran* 125; *Regulus* 133; η *Geminorum* 163, and μ *Geminorum* 193 times. It must be evident, then, that much that is defective in an instrumental point of view, must be compensated and rectified by the frequency of the observations; and, although eclipsed by the catalogues of Bradley and Piazzi, the author, considering the great age of Flamsteed's, regards it as possessing a degree of interest, in common with all ancient and authentic records, which ought never to be lost sight of.

He therefore conceives that it would be an object highly worthy

the attention of astronomers, to re-examine and re-reduce the original observations of Flamsteed, with the aid of all the accessions of accuracy which modern improvements have introduced in the determination of the corrections. The chief difficulty would lie in the corrections for the barometer and thermometer, which Flamsteed has not recorded. But he remarks that, should no registers of these instruments at that period and in that district be found elsewhere, no great error would arise from employing a mean state of the barometer, and adopting a scale of temperature deduced for each day in the year, from the meteorological journal of the Royal Society, from a mean of several years by night as well as by day.

It is not known at what precise period Flamsteed's catalogue was constructed; his observations were made between 1689 and 1719, and the reductions were performed between 1696 and 1708. But, besides the observations reduced and published in his catalogue, there exist in his journal a great many which have never yet been reduced at all. Miss Caroline Herschel has discovered no less than 560 of this kind, and these are probably not all. These ought to be included in any re-computation which may be set on foot.

One peculiarity in Flamsteed's mode of observation is to be considered as fortunate, not only as affording facilities for reduction, but as producing a probable exemption from many instrumental errors; viz. that it appears to have been his practice to observe in zones. Still, the task of reduction could not but be considerable. Mr. Baily, however, conceives that great benefit could not but result were it only partially executed; reducing 200 or 300 of the principal stars from the *total* observations of each star. If this were done, it would authorise a fair judgment of the value of the whole mass; and were such partial reduction attended with satisfactory results, he thinks no doubt could exist that public spirit enough would be found to support and carry through the bold and difficult undertaking he suggests. To any one who may be inclined to make the preliminary trial, he recommends as a useful aid Miss Herschel's "Catalogue of Stars, taken from Mr. Flamsteed's Observations," published by the Royal Society in 1798, which contains a list of all the stars observed by him, but not in his catalogue, as well as an index to every observation of every star, and a copious list of errata.

Mr. Baily concludes by expressing his hope that these remarks may attract the attention of some astronomer who has both talent and leisure for the pursuit of an inquiry of this kind, and who may thus become the means of restoring Flamsteed's observations to the high rank they once held, and to which it is hoped they will still be found justly entitled.

Mr. Thomas Taylor, jun., of the Royal Observatory at Greenwich, transmitted the following ephemeris of the positions of the four new planets, at their ensuing oppositions, computed by himself; at the same time remarking, that the places of Ceres and Vesta differed materially from the places as given in Bode's *Astronomische Jahrbuch*.

The computations are for the *noon* of each day.

PALLAS.			CERES.		
1827.	Æ	Dec. N.	1827.	Æ	Dec. S.
Aug. 7	22h 10m 46s	9° 56′	Sept. 6	0h 57m 23s	14° 23′
8	10 5	9 48½	7	56 50	14 30
9	9 24	9 40½	8	56 15	14 37
10	8 42	9 32	9	55 39	14 44
11	7 59	9 24	10	55 2	14 51
12	7 16	9 15½	11	54 23	14 58
13	6 33	9 7	12	53 43	15 4
14	5 49	8 58½	13	53 2	15 10
15	5 4	8 49½	14	52 20	15 16
16	4 19	8 40	15	51 37	15 22
17	3 34	8 30½	16	50 53	15 28
18	2 49	8 21	17	50 7	15 34
19	2 4	8 11	18	49 20	15 40
20	1 19	8 1	19	48 32	15 46
21	22 0 34	7 51	20	47 44	15 51½
22	21 59 48	7 40½	21	46 56	15 57
23	59 2	7 30	22	46 7	16 2½
24	58 16	7 19	23	45 17	16 8
25	57 30	7 8	24	44 26	16 13
26	56 44	6 56½	25	43 35	16 17½
♂ 27	55 58	6 45½	♂ 26	42 44	16 22
28	55 12	6 34	27	41 52	16 26½
29	54 26	6 22½	28	41 1	16 31
30	53 41	6 11	29	40 9	16 35½
31	52 56	5 59½	30	39 17	16 40
Sept. 1	52 12	5 47½	Oct. 1	38 25	16 44
2	51 28	5 35½	2	37 32	16 48
3	50 45	5 23½	3	36 40	16 51½
4	50 2	5 11½	4	35 48	16 55
5	49 20	4 59	5	34 56	16 58
6	48 39	4 47	6	34 4	17 1
7	47 58	4 34½	7	33 12	17 4
8	47 18	4 22	8	32 21	17 7
9	46 39	4 9½	9	31 30	17 9½
10	46 1	3 57	10	30 39	17 11½
11	45 24	3 44½	11	29 48	17 13½
12	44 47	3 32	12	28 58	17 15
13	44 11	3 19½	13	28 8	17 16
14	43 35	3 7	14	27 19	17 17
15	43 1	2 54	15	26 30	17 17½

VESTA.			JUNO.		
1827.	Æ	Dec. N.	1828.	Æ	Dec.
Nov. 25	$5^h\,50^m\,58^s$	18°43′	March 5	$12^h\,42^m\,35^s$	−0°38′½
26	50 10	18 44½	6	41 57	−0 31
27	49 20	18 46	7	41 18	−0 23½
28	48 28	18 47½	8	40 38	−0 15½
29	47 34	18 49	9	39 58	−0 7½
30	46 39	18 50½	10	39 18	+0 0½
Dec. 1	45 42	18 52	11	38 37	+0 9
2	44 44	18 53½	12	37 55	+0 18
3	43 44	18 55	13	37 12	+0 27
4	42 43	18 56½	14	36 28	+0 36½
5	41 31	18 58	15	35 42	+0 45½
6	40 38	18 59½	16	34 56	+0 54½
7	39 34	19 1½	17	34 10	+1 3½
8	38 29	19 3	18	33 23	+1 12½
9	37 23	19 4½	19	32 36	+1 21½
10	36 17	19 6	20	31 49	+1 30½
11	35 10	19 8	21	31 2	+1 39½
12	34 3	19 9½	22	30 14	+1 48½
13	32 56	19 11½	23	29 26	+1 57
14	31 48	19 13	24	28 39	+2 6
♂ 15	30 40	19 15	♂ 25	27 52	+2 15
16	29 32	19 17	26	27 4	+2 23½
17	28 24	19 18½	27	26 16	+2 32½
18	27 17	19 20½	28	25 28	+2 41
19	26 10	19 22	29	24 41	+2 49½
20	25 3	19 24	30	23 55	+2 58
21	23 57	19 26	31	23 8	+3 6½
22	22 51	19 27½	April 1	22 21	+3 14½
23	21 46	19 29½	2	21 36	+3 23
24	21 42	19 31	3	20 50	+3 31
25	19 39	19 33	4	20 5	+3 39
26	18 36	19 35	5	19 20	+3 47
27	17 34	19 37	6	18 36	+3 54½
28	16 31	19 39	7	17 52	+4 2
29	15 29	19 41	8	17 9	+4 10
30	14 28	19 43	9	16 27	+4 17½
31	13 27	19 45½	10	15 46	+4 25
1828.			11	15 5	+4 32½
Jan. 1	12 27	19 47½	12	14 25	+4 39
2	11 28	19 49½	13	13 44	+4 46
3	10 30	19 52			

There was next read a paper by Mr. Utting, "On a *new period of eclipses.*" In this communication, Mr. Utting adverts to the well-known Chaldean periods of 223 lunations and 6890 lunations: but besides these, there are others that have been brought in aid of computations relative to eclipses. The new period, which Mr. Utting proposes, consists of 3803 lunations, or about 307 Julian years and 174 days; at the end of which time he says the sun and moon will be in conjuction at the opposite node to that from which they started: and at the end of 7606 lunations they will be in conjunction at the same node. Mr. Utting gives the secular motions of the sun's longitude and anomaly, and of the moon's longitude, anomaly, and node, from the most recent tables; from which he deduces the correct period of a mean lunation; and thence the necessary quantities for the computation of the time of the mean conjunctions.

The next papers were a series of observations by Major Hodgson: 1°. On the transit of Mercury over the sun's disc, on Nov. 4, 1822. 2°. Occultations of stars by the moon; particularly of the *Pleiades* on March 17, 1823. 3°. A set of equal altitudes for determining the time at Futty Ghur. 4°. Transits of Moon and moon-culminating stars at the same place.

Mr. Baily read the following extract of a letter from Professor Harding, of Göttingen.—"You will be pleased to hear of a small *variable* star, which I have discovered since June 9th, in last year. It is situated in *Serpens;* and my observations (which however are not very correct) give its position for 1800, as follows:

$$\text{R} = 235^\circ\ 22'\ 3'' \qquad \text{D} = +15^\circ\ 44'\ 48''$$

It has at this time its greatest light; and will soon begin to diminish. As far as I have yet observed, its period seems to be about eleven months. This star is neither in the *Histoire Céleste,* nor in Bessel's *Zones:* nor have I observed it before the year 1826. When smallest, it is *entirely invisible.*"

A letter was read from Mr. George Innes, of Aberdeen, giving the results of his computations relative to the solar eclipse of the 28th of November last. He states, that in calculating the parallaxes in longitude and latitude, he used the method of the Nonagesimal, and went over the process for each of the places, both according to the method used by Dr. Brinkley, and to that of Delambre. The difference in the results did not, in any case, exceed three-tenths of a second. For the reduction of the latitude, and equatorial parallax, the compression $\frac{1}{309}$ was used. No corrections were applied to the semidiameters of the sun or moon, for irradiation or inflexion. The augmentation of the moon's semidiameter for each of the places was obtained from Delambre's formulæ *only.* The following are the observations used in the computations, which are all expressed in *mean time.* In computing the Greenwich observation, he adopted that which was made with the five-feet equa-

torial: but it appears from the observations made at other places (except Dublin) that some of the others are nearer the truth.

Bushy Heath =	28d	21h	46m	4s,0	beginning
	28	23	58	19,0	end.
Epping .... =	29	0	0	54,0	end.
Greenwich.. =	29	0	0	11,5	with 25 inch achrom.
	..	..	..	12,4	with 46 inch do.
	..	..	..	13,4	with 5 feet equat.
	..	..	..	16,5	with 30 inch achrom.
	..	..	..	18,0	with 7 feet Newt.
					} end.
Dublin .... =	28	23	25	30,0	end.
Armagh ... =	28	23	24	10,8	end.
Aberdeen .. =	28	23	49	45,1	end.

From these observations Mr. Innes obtained the following results:

	Conjunction Nov. 28. *Apparent* time.	Longitude.
Bushy Heath *b*	23h 35m 50s,66	
Bushy Heath *b* & *e*	35 50,19	
Bushy Heath *e*	35 47,64	1m 25s,57 W.
Epping	37 38,08	0 24,87 E.
Greenwich	37 13,21	
Dublin	11 51,40	25 21,81 W.
Armagh	10 34,23	26 38,98 W.
Aberdeen	28 48,30	8 24,91

The results deduced from the observations at Bushy Heath marked *b*, *b* and *e*, and *e*, are obtained from the *beginning* of the eclipse, from the *beginning and end* conjointly, and from the *end*. And from *these* observations Mr. Innes obtains +9″,68 for the error of the tables in longitude, and −2″,44 for the error in latitude. The lunar tables made use of were the recent ones of M. Damoiseau: and Mr. Innes has subjoined to his paper the whole of the elements employed in the calculations.

A description of an instrument called a *Tangent Sextant*, intended to determine the distances of objects from an observer, when their distances from each other are known, was communicated to the Society by Captain John Ross, R.N., who states that it was invented by an eminent land-surveyor, who lived to finish but two of them; and Captain Ross has since made some improvements in the instrument.

The index-mirror is placed diagonally across the bar of the index, having the centre in a line with the front edge of the index; and, in observing, the telescope is so placed that the centre of the instrument is towards the observer, and the limb directed towards the

objects, which are brought in apparent contact, as in other reflecting instruments. The edge of the revolving index intersects another fixed and graduated radius, passing through the zero of the limb; and the figures at the point of intersection indicate the number of times which the distance of the objects from each other is contained in the distance of the observer from the nearer of them, *when the angle at the nearer object is a right angle*, the only case of the problem which, in this application of his instrument, the inventor appears to have had in contemplation.

A method of making the necessary computations for deducing the longitude from an occultation of the moon, by Lieut. C. R. Drinkwater, R.N. was read. In the method proposed by Mr. Drinkwater, the sun's right ascension, and the moon's declination, horizontal parallax and semidiameter, are taken from the Nautical Almanac for the approximate Greenwich time; and the star's meridian distance being found, the latitude and parallax are corrected for the earth's ellipticity.

Then, calling the reduced horizontal parallax P, the star's meridian distance M, its polar distance p, and the latitude l; he computes arc A, from $\tan A = \cos M \,.\, \cot l$; arc B, from $B = p \pm A$; C, the principal effect of parallax in polar distance from $C = P \,.\, \sin l \,.\, \sin B \,.\, \text{sect } A$, (— when A is less than p, otherwise +, unless M exceeds 6^h, when it is always —); D the parallax in right ascension from $D = P \,.\, \cos l \,.\, \sin M \,.\, \text{cosect } p$ (—when the star is east of the meridian, otherwise +); and E, the final correction of declination from $E = \frac{D^2 \,.\, \sin 2p}{\sin 1''}$ (always —). And having thus found the declination of the point of occultation, the difference between it and that of the moon's centre is known; and from this difference, the moon's semidiameter, and the declinations of both objects. Mr. D. computes in the usual way the difference between the right ascension of the planet, and hence finds the right ascension of the moon's centre; from which, by interpolating in the Nautical Almanac, he finds the Greenwich time.

The business of the evening being concluded, Professor Amici (one of the Associates of the Society), at the request of the President, obligingly permitted the inspection of several instruments of his invention and workmanship. The principal were, a new compound achromatic microscope, a reflecting circle on a new construction, and a prismatic reflecting sextant. The microscope is formed with three achromatic double object-glasses, applied separately, or in combination; their common axis is directed vertically downwards, and the refracted pencil is turned into a horizontal position by internal reflexion at the base of a right-angled prism, for the convenience of observation, and after passing along the axis of a tube about seven inches long, received on the eye-piece. The object is powerfully illuminated from below by the reflected light of an Argand lamp, or daylight, collected in the focus of a large concave mirror. Several objects were viewed, such as the feathers on the wing of a

butterfly, the pollen of the mallow, &c., which were shewn with the utmost distinctness and beauty with powers of 700 and 1500* (the latter as stated by Mr. A. to have been determined by himself in conjunction with M. Arago in Paris).

The reflecting circle consists of two circles, of about six inches diameter, revolving one within the other, the outer of which carries the verniers, on which the divisions of the inner are read off to 20″. To each of these circles, in a plane perpendicular to its own, and intersecting it in an exact diameter, is attached a long narrow plane reflector, in breadth equal to half the object-glass of the telescope, and in length, nearly to a diameter of the circles, and so contrived as to lie wholly below the plane of the limb, or at the backs of the circles, and to have their edges almost in contact, and intersecting exactly in the prolongation of the common axis of both circles; by which means parallax is avoided, and the necessity of a reduction to the centre, when the angles between near objects is taken, obviated. The attachment of these reflectors to the circles, so as to preserve the requisite freedom of motion and stability of the centre-work, is performed by a frame-work easier to imagine than to describe without a figure. The telescope is attached to the limb of the vernier circle (which is either held in the hand by a proper handle, or supported on a pillar and counterbalanced). Its object-glass is covered half by one of the reflectors and half by the other; and the images of two objects seen by reflection in each, being brought to coincide, it is manifest that the angle between the reflectors (which is equal to half the angle subtended by the objects at the centre of the instrument) will be read off on the divided limb. The principal advantages offered by this construction are, the avoiding of parallax, and a power of measuring the same angle on four different parts of the limb (independent of the four readings of the verniers).

The prismatic reflecting sextant is nearly on the same principle, only that the internal reflexion at the bases of right-angled glass prisms is here employed in the place of metallic or silvered glass mirrors. It has, we believe, been described in the *Correspondence Astronomique* of Baron Zach, for which reason it is unnecessary to give any further account of it here.

* These powers, however extraordinary they may seem, are not exaggerated. The writer of this notice has since, more than once, witnessed, and taken part in, the determination of several of the powers of the microscope in question, under various combinations, in the presence of M. Amici himself, and several gentlemen of the greatest experience in such trials; when the results for four combinations tried were respectively 300, 700, 1120, and 3159 (all for *linear* measure). With the last enormous power, vision was still *tolerably* distinct, though necessarily very obscure: with all the others admirably perfect.

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